

**ORIGINAL**

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of )  
 )  
Revisions of the Commission's Rules )  
To Ensure Compatibility with )  
Enhanced 911 Emergency Calling )  
Systems )

CC Docket No. 94-102

DA 99-1049

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**COMMENTS OF KSI INC.**

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June 17, 1999

No. of Copies rec'd 0 F10  
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## **TABLE OF CONTENTS**

	<b><u>Page</u></b>
I. INTRODUCTION AND SUMMARY .....	1
II. “TECHNOLOGY NEUTRALITY” CANNOT BE ACCOMPLISHED BY ELEVATING ONE SOLUTION OVER ANOTHER THROUGH WAIVERS .....	2
A. Handset-Specific Waivers.....	2
B. What is the True Measure of the Cost of Implementing Phase II ALI? .....	8
C. Dispelling the Myths of Network Solutions .....	9
III. THERE IS NO PANACEA FOR E911 PHASE II HANDSET SOLUTION ROAMING PROBLEMS .....	10
IV. METHODOLOGIES .....	12
V. CONCLUSION.....	13
APPENDIX	

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**COMMENTS OF KSI INC.**

KSI Inc. (KSI), by its attorneys, respectfully submits the following Comments in response to the Commission's Public Notice, DA 99-1049 (released June 1, 1999) in the above-captioned proceeding. For all of the reasons stated below, KSI urges the Commission to maintain its commitment to the October 1, 2001 deadline for the implementation of E911 Phase II requirements.

**I. Introduction and Summary**

KSI is a leading developer of location solutions for integration into wireless communications networks, and has demonstrated repeatedly through field tests, live demonstrations and other efforts that its TeleSentinel™ system is already capable of meeting or exceeding the Phase II requirements adopted by the Commission. In fact, just recently, Commission staff members traveled to KSI's headquarters and witnessed first hand TeleSentinel's™ proven AMPS/TDMA capabilities.

For over a decade, as both a participant in FCC Docket 90-314, and as a leader in early industry discussions regarding wireless location services, KSI has been a proponent of the public safety benefits of utilizing location techniques in emergency situations involving wireless communications. To that end, KSI has made significant contributions in every stage of this

Docket and in industry efforts designed to timely bring the benefits of wireless location technologies to all of this nation's wireless telephone users.

Specifically, KSI has developed its patented TeleSentinel™ location system using angle of arrival technology (AOA) and other technologies to determine the location from which the radio frequency (RF) transmissions of a wireless communication originate. Through sophisticated processing of data concerning the RF transmission carrying the 911 communication, KSI's TeleSentinel™ system provides ALI with a level of accuracy that meets the Commission's Phase II requirements.

In the past year, KSI has successfully field tested its second generation digital wireless telephone location system. This AMPS-TDMA system locates both analog (AMPS) and digital (TDMA) wireless phones. The development of this location technology can provide both AMPS and TDMA-based carriers with the location capability necessary to comply with the Commission's Phase II ALI rules.

As set forth fully below, KSI believes that for the Commission to adopt technology specific waiver standards to advance the interests of a single Phase II Automatic Location Information (ALI) approach over others contravenes the stated objectives of the Commission in this Docket, fails to advance the public interest, and lacks support within the record.

## **II. "Technology Neutrality" Cannot be Accomplished by Elevating One Solution Over Another Through Waivers**

### **A. Handset-Specific Waivers**

In its June 1, 1999 *Public Notice* the Commission seeks comment regarding "whether to adopt standards for handset approaches similar to those outlined in two specific proposals submitted in this proceeding."<sup>1</sup> Specifically, the Commission requests "targeted comment" on

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<sup>1</sup> "Wireless Telecommunications Bureau Requests Targeted Comment on Wireless E911 Phase II Automatic Location Identification Requirements" *Public Notice*, DA 99-1049 at 2-3 (rel. June 1, 1999) (*June Public Notice*).

proposals submitted by SnapTrack and the Association of Public Safety Communications Officials-International, Inc. (APCO). Both of these proposals, however, outline standards targeted at providing waivers for the implementation of handset-based solutions.

In the Phase II Working Group Comments which responded to the Commission's December *Public Notice* requesting the submission of waivers, and in its Reply Comments opposing such requests for waiver, KSI urged the Commission to maintain its commitment to the implementation of Phase II E911 requirements by October 2001.<sup>2</sup> Indeed, KSI noted that the wholesale grant of waivers for handset-based solutions would establish one set of rules for parties, like KSI, who have participated in this proceeding since its inception and who have been working toward the Phase II deadline, and a second --and more favorable--set of rules for other parties -- who now promote the wide scale replacement of handsets -- and who were latecomers to this proceeding and to industry efforts to utilize location technology to meet critical public safety needs. Moreover, as KSI noted in its Reply Comments, the record compiled in response to the December *Public Notice* was devoid of meaningful responses to the specific information requested by the Commission to support the grant of waivers.

Following a massive lobbying effort by those parties who wish to sell new wireless handsets to the 70 million Americans that have already bought them, the Commission's most recent *Public Notice* seems to suggest that through a waiver process it may effectively reverse its earlier decisions in this Docket. Beyond even the manifest procedural deficiencies in this approach, KSI strongly believes that any adopted waiver standard that has the effect of establishing a preference for one ALI solution over any other flatly contradicts the Commission's stated commitment to technological neutrality. The *Public Notices* regarding wholesale waivers

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<sup>2</sup> See Comments of the Phase II Working Group dated February 4, 1999; KSI Reply to Comments and Requests for Waiver of Section 20.18(e) dated February 16, 1999.

of the Rules to promote handset-based solutions, indeed, have created regulatory uncertainty that has harmed companies, like KSI, that seek to acquire capital funding to continue to timely meet the Commission's Phase II requirements. More importantly, this regulatory uncertainty has threatened the public interest by delaying the implementation of Phase II ALI.

Waivers designed to accommodate a specific technology will effectively eviscerate the Commission's rules. By granting waivers and developing separate standards to accommodate developers of handset-based solutions, the Commission will effectively endorse the use of that technology. Additionally, the mere existence of waivers and separate regulatory standards designed to accommodate handset-based approaches will likely chill investment in network based solutions as well as carrier interest in utilizing the technology.

The Commission cannot through the waiver process completely emasculate its own mandates. KSI, like other network solution providers, formulated its business strategies, including the pursuit of critical capital funding, and the development of its technological solutions, based on the timelines set forth in the Commission's Phase II mandates. Thus, any waiver directed at simply accommodating the participation of a single technological solution will clearly change the rules, and do so after the fact.

KSI encourages the Commission to recognize that its rules should establish a level playing field for all technologies. Instead, KSI believes, the *June Public Notice* attempts to level the technologies playing on the field by neutralizing a key advantage of network-based technologies – the ability to locate all wireless phones – to the clear detriment of the public interest goals of this proceeding. Moreover, if waiver standards are crafted to allow a carrier utilizing a handset solution to have additional time to comply with the Commission's rules, then it is likely that carriers will be less inclined to spend their time and money on testing and implementing network solutions today for full implementation by October 1, 2001.

Rather than adopt either of the approaches suggested by SnapTrack or APCO, which are clearly biased in that they are designed to create different sets of rules for handset and network solutions, the Commission must adhere to a single set of Phase II ALI requirements. Initially, the Commission's efforts to provide for "technologically and competitively neutral" Phase II ALI requirements led to the adoption of performance criteria rather than extensive technical standards.<sup>3</sup> KSI fully supports the Commission's decisions in this regard, and continues to believe that all location technologies that can satisfy the needs of the public safety community will rigorously compete in the marketplace on equal footing. As it has stated previously, KSI believes that through robust competition in the marketplace, wireless carriers may ultimately rely upon more than one location technology to provide E911 capabilities. In addition, deployment of network based solutions in the near term would not necessarily disadvantage handset capabilities and features if and when they become commercially available.<sup>4</sup> KSI reiterates, however, that such a result should derive from the market forces of fair competition fostered by technology neutral regulatory standards rather than special accommodations made for one technology over another.

Accordingly, KSI continues to believe that waivers are unnecessary, that the rules as drafted are technologically neutral, and that ALI solutions, including KSI's TeleSentinel system, currently exist and can satisfy the Commission's Phase II requirements. Based on the record in this Docket, KSI does not believe that the Commission will find any benefit in the current proposals for technology specific waiver standards. As a practical matter, SnapTrack's and APCO's proposals to redefine the Phase II ALI location accuracy by 35 meters and to begin

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<sup>3</sup> "In Re Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems," CC Docket 94-102, *Memorandum Opinion and Order*, 12 FCC Rcd 22665, 22724-25 (1997) (*E911 Reconsideration Order*).

<sup>4</sup> For instance to solve fraud problems in wireless phones, carriers in high exposure areas ultimately introduced solutions utilizing both handset and network solutions.

initial deployment of handsets nine months ahead of the Commission's October 2001 deadline lack substantive value and are simply red herrings.<sup>5</sup> First, the Commission's 125 meter accuracy requirement was not designed to be the best location an ALI solution can or should provide, but instead was established as an outside parameter of the minimum accuracy required to ensure public safety. KSI has repeatedly stated on the record that it can and will do better than the Commission's established accuracy requirements. Indeed, in its Comments in this Docket over four years ago, KSI suggested that the FCC adopt a 100 meter accuracy standard. Second, the October 1, 2001 date established by the Commission for Phase II implementation was a deadline and not a start date, and therefore should not be viewed as such. Carriers, of course, can also implement network-based solutions by January 1, 2001, or earlier for that matter. Likewise, any perceived benefit from an earlier deployment of Phase II ALI handsets is far outweighed by the public detriment of a proposed five year phased-in implementation schedule. Further, there is no guarantee that any proposed implementation readiness for handset deployment will correspond with customer interests and demands in the type of handset they choose to purchase. In fact, it is uncertain whether a GPS handset will ever correspond with market demand for light weight, mobile phones with long battery lives. Finally, there is nothing technologically unique in these proposals because network solutions could begin to be deployed now if carriers so choose and can accomplish better accuracy than that currently mandated. Furthermore, network solutions can do so without having to take into consideration the proposed different measurement standards commented on below.

KSI agrees with and supports the Comments of the National Emergency Number Association (NENA). As noted by NENA, it is regrettable that the focus of this Docket has

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<sup>5</sup> See Letter to Magalie Roman Salas, FCC, from Glenn Manishin, Attorney for SnapTrack, CC Docket 94-102, dated June 1, 1999 at 4 (*SnapTrack Ex parte*); Further Comments of APCO dated May 25, 1999 at 2-3.

shifted from the critical public safety benefits of ALI to that of technology and carrier convenience.<sup>6</sup> The Commission, having determined that it is technologically feasible for wireless carriers to provide location information in emergency circumstances, should not be the final arbiter of the technological debate between location solution providers. Instead, market forces should be allowed to determine which technology is most desirable to enable carriers to satisfy the Commission's requirements. Inherent in such a market selection theory, however, is the presumption that the Commission's requirements will be neutral and fairly applied, despite the choice of technology.

To the contrary, in the instant matter, trade press and industry members are already speculating that the Commission's June *Public Notice* has "stacked the deck" in favor of handset solutions.<sup>7</sup> As the trade press accurately notes, by "reshuffling" the Phase II E911 mandates, the Commission has "raised the ante to handset-based vendors' advantage."<sup>8</sup> Thus, industry consensus acknowledges that the Commission's suggestion that it might adopt waiver standards for the implementation of handset solutions eludes its stated goal of attaining technology neutrality. Further, KSI firmly believes that despite the Commission's best intentions, the continued uncertainties raised by the repeated requests for comment on waivers will cause further delay in the implementation of location technologies.

Like NENA, KSI believes that the Commission should affirm the E911 rules that it has so thoroughly debated since 1994. Not a single public safety benefit merits the revision or delay of the Commission's Phase II requirements. Moreover, not a single carrier has formally committed to employing handset based technologies. Instead, carriers are standing on the sidelines taking

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<sup>6</sup> See NENA Comments dated June 10, 1999 at 1.

<sup>7</sup> See "FCC Stacks the Deck Toward Allowing Handset-Based Solution," *Public Land Mobile Radio News* at 5 (June 4, 1999).

<sup>8</sup> *Id.*

advantage of the delay while the Commission examines issues of technology neutrality. As a policy matter, the only way the Commission can continue to ensure technology neutrality is to treat all technologies in a like manner and set a uniform implementation schedule.

**B. What is the True Measure of the Cost of Implementing Phase II ALI?**

Despite handset solution providers' claims of being the low cost alternative to providing Phase II ALI, it is uncontested that significant, and perhaps insurmountable, costs attach to replacing the over 70 million wireless phones that are currently in use in this country. KSI maintains that to gauge the actual cost of deploying a handset based solution, the Commission must combine the embedded base of 70 million wireless handsets in the market today with the number of wireless handsets that will reach the market by 2001, and then multiply that staggering number by the average cost that the carrier pays when purchasing a wireless handset from a manufacturer. That number, which conservatively is over ten billion dollars, would represent the investment that has been made in equipment that handset solution providers propose to totally disregard. In addition, the Commission must consider the investment necessary to deploy GPS enabled handsets to comply with the Commission's Phase II requirements. Moreover, the Commission must factor in the cost of modifying wireless communications networks in order to extract the location information from the handset. An accurate analysis of the cost of handset solutions cannot disregard all these components.

In this regard, proponents of handset-based solutions plainly acknowledge that their technology can only be considered a cost effective technological solution if carriers do not have to replace or retrofit the embedded base of handsets.<sup>9</sup> KSI believes that any Phase II ALI proposal that does not address the embedded base of handsets is actually no solution at all. It is

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<sup>9</sup> See SnapTrack Comments dated February 25, 1999 at 10 ("Carriers are undoubtedly correct, however, that a rule requiring the mandatory replacement of older handsets as a condition of Phase II waivers would impose substantial and likely prohibitive cost on carriers.")

certainly far easier for handset solution proponents to boast of the cost effectiveness of handset solutions when their solutions only address a portion of the Phase II location requirements established by the Commission, and ignore the well over 10 billion dollar cost attached in discarding the embedded base of handsets. Further, KSI contends that it is disingenuous for SnapTrack to argue in a recent *ex parte* that “network-based ALI approaches are incomplete and extremely costly.”<sup>10</sup> When the cost of meeting all of the Commission’s Phase II requirements are analyzed, it is undeniable that network solutions are the more affordable and cost effective alternative in the long run for the carriers and thus, for the consumers of wireless communication services.

Moreover, as NENA points out, “there has been no discussion of the costs to public safety agencies of prolonged delay in automatic wireless 911 location, in longer times for handling calls, in multiple unit dispatch, and in expensive searches.”<sup>11</sup> In the final analysis, KSI believes that the true measure of cost in the provision of ALI must be determined not by technological price tags, but rather by the cost of lives lost while the intended implementation of the Commission’s rules is delayed, or worse yet, permanently waived. Much time and attention went into the promulgation of the Commission’s decisions in this Docket. That should not be cast aside now because certain providers of a fledgling technology believe that they might have a “better” solution if they are allowed additional years for implementation.

### **C. Dispelling the Myths of Network Solutions**

In the technology debate that has arisen in this Docket, misinformation has been submitted regarding the capabilities of network-based location solutions. For instance, certain commenters argue that radio-triangulation network location systems do not make sense for rural

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<sup>10</sup> See SnapTrack Ex Parte at 2.

<sup>11</sup> NENA Comments dated June 10, 1999 at 7.

operations, stating that at least three sites are required for reliable locations.<sup>12</sup> To the contrary, as KSI has previously explained, reliable and accurate locations are routinely available with only two receiving antenna sites using its AOA techniques. Moreover, KSI is developing a single site location capability that will be well suited to provide locations in appropriate environments, *e.g.*, rural environments with antenna sites aligned along highways.

Other commenters also erroneously state that the provision of ALI for TDMA phones is unavailable.<sup>13</sup> As noted above, and as witnessed firsthand by Commission staff, KSI's TeleSentinel system currently provides this capability. As KSI has repeatedly stated, its TDMA capabilities are also equally applicable to SMR signals in the iDEN format. Moreover, KSI is currently developing CDMA and GSM signal location adaptations, appropriate for single and multiple site deployments of its location technologies.

### **III. There is no Panacea for E911 Phase II Handset Solution Roaming Problems**

Over 70 million wireless phones are in use in the United States today, many of which have been marketed and purchased for the sole purpose of personal safety. In the next two years, according to industry projections of wireless use, the number of new wireless handsets in circulation will continue to rise exponentially. To date, not a single commenter has been able to state with specificity how a wireless subscriber using an existing handset and roaming on a system employing a handset-based solution might be located by that carrier as mandated by the Commission's Phase II requirements. The simple and undeniable fact of the matter is that there is no current handset solution to the roaming problem. Yet, several commenters have sought to minimize the roaming problem by noting that a wireless subscriber who does not have a location

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<sup>12</sup> See *e.g.*, Chariton Valley Wireless Services Request for Waiver at 2; New Mexico RSA 6-III Partnership Request for Waiver at 2; Arctic Slope Telecommunications and Cellular Inc. Request for Waiver at 2; Brazos Cellular Communications Ltd. Request for Waiver at 2.

<sup>13</sup> See *e.g.*, Tritel Comments at 3-4.

enabled handset will still have Phase I ALI information accompanying a call.<sup>14</sup> Although at first blush this may seem sufficient, KSI strongly believes that Phase I location information is not a practical solution for Phase II handset solution roaming problems. Certainly, this Commission does not believe so. In fact, even the request of the Wireless Consumers Alliance (WCA) to modify the Commission's rules to mandate GPS capabilities in all newly manufactured handsets supports KSI's beliefs that Phase I information is not a solution for the roaming problem. Standing in direct contradiction of other proponents of handset solutions, WCA admits that Phase I location information is of little value.<sup>15</sup>

In sum, proponents of handset solutions cannot have it both ways. On the one hand they propose minimally improved accuracy from GPS solutions as an enticement to this Commission to adopt separate standards for the implementation of handset solutions. But when addressing the roamer issue they are so bold as to suggest that the Phase I location information is adequate to render assistance to emergency callers in such circumstances. Such an illogical juxtaposition insults the intelligence of the Commission and wholly disregards the needs of roaming consumers without location enabled handsets.

By the same token, Sprint's suggestion that a software modification within its network could solve the roaming problem if it chooses to implement a handset solution for the provision of Phase II ALI is equally troubling. The Commission has gone to great lengths to establish an accuracy standard requiring carriers to locate all wireless callers with an accuracy standard of a 125 meters. To suggest it is somehow sufficient to locate roaming wireless callers with an accuracy standard of 285 meters is without record support. Moreover, while KSI is not

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<sup>14</sup> See e.g., AirTouch Communications Petition at 14.

<sup>15</sup> See Petition of Wireless Consumer Alliance, Inc. to Modify 47 C.F.R. Section 20.18(e)&(f) dated June 1, 1999 at 3. KSI believes that WCA's proposal to alter the Commission rules to allow a new technology the time to catch up to industry pioneers is anticompetitive at best and at worst is reckless given the impact on public safety. Moreover,

completely familiar with the software solution that Sprint has suggested, it is not clear that such a solution is available for all air interfaces. So it may be very risky to rely on this sort of a "fix" as the overall solution for locating roamers with the implementation of a handset solution.

#### **IV. Methodologies**

To clarify and overcome potential anomalies with the E911 accuracy requirement, KSI recommends adoption of Ericsson's proposal of a root mean square (rms) of the "90th percentile sub-ensemble," because this percentile ignores a relatively "small" percentage (10%) of the applicable data samples in a statistical ensemble of measurements. In accord with the FCC's initial use of a rms statistic, KSI feels that the "percentile-based rms" still represents an "average" value to be expected by any interested party, while the use of the "90th percentile rms" avoids the "biased" results that can occur with the mean of the full ensemble. The record in this Docket has shown that, despite the Commission's intent, those seeking to provide minimal performance will misinterpret a percentile-based accuracy requirement to infer that Phase II locations are not required for the percentage excluded in the accuracy-percentile calculation. In its *Memorandum of Opinion and Order*, the Commission has rejected the notion that 33% of the statistics may be ignored. Similarly, the use of a "GPS-based CEP," as proposed by handset solution proponents, would be quietly abused in the discard of 50% of the statistics and should be rejected. As described above, the 90th percentile rms preserves an acceptable statistical percentage. Normally, with circularly symmetric error-distance statistics, the rms of the 90th percentile sub-ensemble is 0.86 times the rms of the entire ensemble. Thus the acceptance criterion may be scaled in association with the specified statistic and its probabilistic implications. It would be appropriate to adopt a 105 meter criterion for the 90th percentile rms, as equivalent to the previous full ensemble rms of 125 meters.

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its proposal to modify the Commission's rules to mandate such a technology must be dismissed outright as it goes

Thus, KSI recommends that rule 20.18(e) be changed to read:

(e) Phase II Enhanced Services. As of October 1, 2001, licensees subject to this section must provide to the designated Public Safety Answering Point the locations of all calls by latitude and longitude such that the accuracy for the locations is 105 meters or less using the root mean square (rms) of the smaller 90 percent of the error distances.

## V. Conclusion

For all of the foregoing reasons, KSI believes that the Commission should not adopt either SnapTrack's or APCO's proposed standards for waivers.

Respectfully submitted,

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June 17, 1999

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against the findings and spirit of this proceeding.

## APPENDIX

### E911 Probabilities & ALI Accuracies

As KSI said in the consensus meeting and in its ex parte meeting with the FCC years ago, confusion and ambiguity can and do derive from multiple possible interpretations of how to perform a statistical calculation. Confusion and ambiguity also derive from different uses of the same terms by different individuals or communities, all of whom are "skilled in the art" or "performing in the domain of expertise" relevant to that terminology. The following discussions concern some of the ALI accuracy terms and issues associated with the FCC's E911 requirements.

#### Potentially "Biased" RMS Calculations

The FCC has correctly understood and noted that Ericsson and others have pointed out a potentially "misleading" property of the "mean" of any statistical ensemble. That is, a "mean" value calculated from an ensemble of particular samples of a random variable can be "distorted" or "significantly biased" by even a single "outlier" sample that occurs at a large ("non-representative") "distance" from the bulk of the sample population or ensemble. Since the FCC's accuracy standard is specified as deriving from a "root-mean-square" (rms) methodology, it involves the square root of the mean of the squares of some ensemble statistic(s) and thus is subject to the "outlier" phenomenon. Thus KSI (in multiple 94-102 contributions since 1994) and (now) others have recommended that the accuracy standard be specified by a "percentile" statistic that is associated with a desired "probability of containment," i.e., a probability that an estimated location will be within a specified area around the "truth" or "true location." The distinction between such a probability-based statistic and an "average" or "mean" can be seen in the distinction between a "median" and a "mean." The median is calculated as that value on either side of which 50% of the ensemble statistics occur, whereas the "mean" is calculated as the sum of the ensemble statistics divided by the number of samples in the ensemble. These two values are the same when the statistics are symmetrically distributed throughout their domain, but are not necessarily equal, for example, when the statistics are asymmetrically distributed or when there exists an "outlier" sample with a statistical value that is displaced "far" from those of the rest of the ensemble. As alternative uses of probability-based statistics, parties have suggested the potential use of either the "67% containment radius" or the rms of the smallest 90% of the error distances. That is, as an alternative to a 67% (67th percentile) containment radius, the 10% of the ensemble samples with the largest error distances would be ignored and the remaining 90% of the samples would be used in a rms calculation. Use of either proposed approach, i.e., the 67th percentile radius or the rms of the 90th percentile sub-ensemble of error distances, has the effect of ignoring non-representative outliers.

#### Location-Uncertainty Specifications By Area Size And Probability

With these standard statistical understandings, those routinely involved with the specification, development, test, and evaluation of localization and tracking systems conventionally describe the performance requirements of such a system by an area of containment around truth as well as by the probability that any estimate of the location must be within that area. That is, the operational objective of the system is to determine the location of an object of interest, and subsequently to support a response to that object as required. The efficiency or probability of successfully responding and the time or resources required to respond are directly related to the uncertainty area (in two dimensions) or volume (in three dimensions) associated with the estimated location parameters. Thus the operational requirements specify both the containment area and the probability that any estimate must fall within that area.

### GPS CEP Example Specification Of An Uncertainty Area And Probability

As an example in specifying location system performance standards, the GPS community has adopted a GPS-specific definition of the term "CEP" ("circular error probable"). The adoption of a "circular" error is particularly relevant to the GPS community because the nearly symmetric horizontal distribution of satellites around any candidate location generally results in an approximately circular area of uncertainty. The area of any circle of uncertainty can be specified by one linear parameter, its radius, and the radius of the circular uncertainty area is termed the "CEP," or sometimes the "Rcep." In GPS terms, by convention, the probability that a location estimate will fall within the CEP is 50%. Thus, in the GPS community, the specification of a CEP (radius) inherently includes the specification of both the size of the area of uncertainty and the probability (50%) that any estimate will be within that area. With a "normal" circularly symmetric distribution of errors, the GPS CEP would be a factor 0.79 times the radius of a circle that would contain 67% of the estimates (i.e., the radius of a circle with a probability of containment of 67% would be 26.5% bigger than the CEP). Thus, in betrayal of the "putative benefit" of a claimed better accuracy, a GPS CEP requirement of 90 m would represent an operationally insignificant reduction of only 8.9% from the 98.8 m CEP that attends to an ensemble with a 67th percentile radius of 125 m.

### General Specifications Of Uncertainty Area With Associated Probability

Generally, with the normal application of the principles of estimation theory, the area of uncertainty produced by a (two dimensional) location determination system will be shaped like an ellipse. For the elliptical area of uncertainty, the semi-major axis is not necessarily the same as the semi-minor axis, and thus the Joint Experts Meeting on wireless E911 reported the goal of providing to the PSAP the description of the shape of the uncertainty area along with the location. A circle is a form of ellipse for which these "semi-axes" are each equal to the "radius." The area of the ellipse is the product of the semi-major axis multiplied by the semi-minor axis multiplied by pi, and the area of the circle is the product of the square of the radius multiplied by pi. Thus, for the specification of requirements for location systems in general (e.g., for military applications), the location accuracy requirements or performance characteristics are typically specified both by an elliptical area of uncertainty, which may be represented by a Rcep that is taken to be the square root of the product of the semi-axes of the ellipse, and by the probability that any location estimate falls within that elliptical area.

### KSI Recommends A "90th Percentile RMS" Accuracy Requirement

KSI recommends adoption of the rms of the "90th percentile sub-ensemble," because this percentile ignores a relatively "small" percentage (10%) of the applicable measurement data samples. In accord with the FCC's initial use of a rms statistic, KSI feels that the "percentile-based rms" still represents an average value to be expected by any interested party, while the use of the 90th percentile rms avoids the "biased" results that can occur with the mean of the full ensemble. Nevertheless KSI's systems will accommodate performance evaluation in accord with any unambiguously specified statistical criterion. Normally, with circularly symmetric error-distance statistics, the rms of the 90th percentile sub-ensemble is 0.86 times the rms of the entire ensemble. Similarly, with statistics from an eccentric elliptical ensemble, the 90th percentile rms is 0.79 times the full ensemble rms. Thus the acceptance criterion may be scaled in association with the specified statistic and its probabilistic implications. It would be appropriate to adopt a 105 m criterion for the 90th percentile rms, in conformance with the previous full ensemble rms of 125 m.

### Accuracy Is Required For All 911 Calls

The FCC has made clear that, at the onset of Phase II, a location estimate must be provided for all 911 calls. This is essential for the safety and efficient dispatch of all 100% of the callers, both wireless and wireline. The "accuracy probability" associated with whether or not an estimated location falls within a specified area around truth is not the same as the "availability probability" that a location determination approach produces any location estimate at all. The initial considerations of probability theory associated with the E911 consensus agreement related to the applications of the "accuracy probability," as discussed above. There then followed some speculation in the wireless communications community that the implication of an interpreted "67% requirement" could be taken to mean that the "not-available probability" (that no location at all be provided) could be as large as 33%. The FCC responded with the Memorandum of Opinion and Order in which the fundamental requirement was rephrased to make clear that Phase II locations are to be provided for all calls. It must be clear in the specification of the accuracy requirement that, notwithstanding the percentile or probability for containment around truth, Phase II locations are still required to be provided for all of those in distress. The quick dispatch of emergency response for all 100% of the calls saves the lives of the first caller who needs assistance quickly as well as of the following caller, who finds the dispatcher(s) more rapidly available. It is essential to the public safety of all that feasibly accurate locations be available for 100% of the 911 callers.